Development of Next Generation Memory Test Experiment for Deployment on a Small Satellite

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The original Memory Test Experiment successfully flew on the FASTSAT satellite launched in November 2010. It contained a single Ramtron 512K ferroelectric memory. The memory device went through many thousands of read/write cycles and recorded any errors that were encountered. The original mission length was schedule to last 6 months but was extended to 18 months. New opportunities exist to launch a similar satellite and considerations for a new memory test experiment should be examined.

The original experiment had to be designed and integrated in less than two months, so the experiment was a simple design using readily available parts. The follow-on experiment needs to be more sophisticated and encompass more technologies. This paper lays out the considerations for the design and development of this follow-on flight memory experiment. It also details the results from the original Memory Test Experiment that flew on board FASTSAT.

Some of the design considerations for the new experiment include the number and type of memory devices to be used, the kinds of tests that will be performed, other data needed to analyze the results, and best use of limited resources on a small satellite. The memory technologies that are considered are FRAM, FLASH, SONOS, Resistive Memory, Phase Change Memory, Nano-wire Memory, Magneto-resistive Memory, Standard DRAM, and Standard SRAM. The kinds of tests that could be performed are read/write operations, non-volatile memory retention, write cycle endurance, power measurements, and testing Error Detection and Correction schemes. Other data that may help analyze the results are GPS location of recorded errors, time stamp of all data recorded, radiation measurements, temperature, and other activities being perform by the satellite. The resources of power, volume, mass, temperature, processing power, and telemetry bandwidth are extremely limited on a small satellite. Design considerations must be made to allow the experiment to not interfere with the satellite's primary mission.

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